



ORIGINAL RESEARCH PAPER

Management

FACTORS AFFECTING CROWDFUNDING SUCCESS IN RENEWABLE ENERGY

KEY WORDS: Renewable Energy, Crowdfunding, Signal

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ABSTRACT

Crowdfunding is a feasible alternative to finance renewable energy projects. However, crowdfunding project supporters face significant challenges. We set out to examine the impact of online information on renewable energy crowd funder's investment decision. We collect data from publicly available information on Kickstarter using Python programming language to extract online information from 164 samples. We find that interaction correlates with fundraising success. Furthermore, word impact is a relatively weak signal in the crowd funder's investment decision. Our findings suggest that interaction could be used as a tool to mitigate the information asymmetry problem from crowd funders. The results of this research offer project creators a guideline when designing their crowdfunding fundraising activities.

INTRODUCTION

Environmental issues have been discussed and highlighted over these years. With the advancement of the globally environmental awareness, environment and sustainability have received increase attention over the years. Research from various disciplines emphasized that “mankind is exceeding critical thresholds of environmental pollution with regard to climate change, biodiversity loss and other dimensions of environmental sustainability” (Steffen et al., 2015; Hörisch, 2015). Crowdfunding undoubtedly offers a relatively novel and rather important source of capital. Crowdfunding has become a distinctive channel in connection with supporters who prefer funding environmental entrepreneurs than those of commercial start-up founders (Goran & Mosakowski, 2016). In addition to financing environmental-oriented ventures, many environmental supporters start to fund clean production technologies. (Harte, 2013; Park, 2012; Thorpe, 2014)

The importance and number of environmental entrepreneurship activities continue to rise (Lumpkin et al., 2013; Margolis & Walsh, 2003; McMullen & Warnick, 2015; Zahra & Wright, 2015), and it is found that resource mobilization is the more difficult part for environmental ventures than commercial or profit-focused ventures (Austin et al., 2006). As for environmental ventures, they face with significant difficulties in fundraising than their counterparts in other categories (Brown & Murphy, 2003; Fedele & Miniaci, 2010; O'Rourke, 2010). This phenomenon could be explained that environmental entrepreneurs focus more on environmental impacts on their business instead of business-related skills, experiences and financial consideration (Brown & Murphy, 2003; Ridley-Duff, 2009; Hörisch, 2015). The financing obstacles in renewable energy source include high upfront capital costs, low rate of return relative to fossil fuel investment opportunities and long pay-back period (Mazzucato & Semieniuk, 2018; Le et al., 2020; Qadir et al., 2021). Overall, investors perceive investment in renewable energy sector as uncertain, costly, and risky (Bento et al., 2019).

With orientation of sustainability, environmental entrepreneurs embrace objectives that “focus on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society” (Shepherd & Patzelt, 2011, p137; Goran & Mosakowski, 2016). Goran and Mosakowski (2016) disclosed that while projects with either a social orientation or an environmental one, relative to

commercial-only projects, are not only more likely to achieve their funding goals but also are more likely to receive higher total pledge amounts. It is found that project legitimacy and creativity are mediating effects, and project legitimacy is only effective in technology projects, and creativity partially affects both environmental and social orientation. Besides, another mediating effect of third-party endorsements does influence environmental-oriented projects.

Factors related to the success of environmental entrepreneurs

In addition, among environmental and commercial entrepreneurs, linguistic style is a crucial factor for funding success. With concrete and precise language, through frequent use of interaction and using language low in psychological distancing are cruxes for correct linguistic style. (Annaleena & Maija, 2017). Based on the language expectancy theory (Burgoon et al., 2002; Burgoon & Miller, 1985), Annaleena and Maija (2017) claim that “entrepreneurs seeking crowdfunding need to meet the expectations of their target audience to be successful and that these expectations differ for different social groups” (Annaleena & Maija, 2017, p217; Burgoon & Miller, 1985). Linguistic style in crowdfunding pitch is more important for social entrepreneurs than those of commercialized-oriented (Annaleena & Maija, 2017) and environmental entrepreneurs take advantage of linguistic style to make their projects more comprehensive and accessible for targeted funders and even build a personal relationship with the crowd. However, Hörisch (2015) contradicted the past expectations of environmental-oriented, and his study found that positive impacts of environmental-oriented projects on the success of crowdfunding cannot be observed. Yet, it is elaborated that environmental entrepreneurship is potentially promising in the future (Bartenberger & Leitner, 2013; Lehner, 2013).

Signaling as a quality indicator in crowdfunding

Signaling is certainly a crucial indicator to eliminate the risks from information asymmetry. Under information asymmetry (Ibrahim, 2018), signals are considered ways to lessen asymmetry for follow-on investors (angels and venture capitalists). Based on signaling theory (Barnett, 2007), high cost to remedy information asymmetry makes signals a necessary standard between entrepreneurs and investors in the market. Also, salient signals (Utset, 2013) make it more observable and effective. However, accuracy of signals is important and restricted by large amounts of disclosures on safe securities with the rapid development of networks. The following inner factors are symbols of positively signaling, which is categorized as three main kinds, including signals, incentives, setting targeted goals and motivation. According

to the study of crowdfunding signals (Ibrahim, 2018), a successful crowdfunding campaign is viewed as a positive signal of investments and high quality for follow-on investors, angels and VCs. More reliance on crowdfunding as a signal of investors and venture institutions offers entrepreneurs a more flexible and lower threshold funding method.

Furthermore, incentives are more likely to promote the interaction between borrowers (entrepreneurs) and lenders (founders) through crowdfunding without other financial intermediations. Hildebrand, Puri & Rocholl (2017) found that group leader bids can be viewed as a quality signal through its interactions with before and after eliminations of rewards, thus enhancing the credibility of loans. In conclusion, proper incentives make borrowers more accessible to credit and play as a positive signal for lenders to prudently censor loan applicants.

As for targeted goal and motivation, these two factors are related to each other and have interactive influences on the final crowdfunding success. From the study about contributions to crowdfunding projects, some elements are involved such as prosocial motivation and goal gradient effect through crowdfunding communities like Kickstarter (Kuppuswamy & Bayus, 2016). Prosocial motivation results from people's helping hearts, and this behavior is crucial for reward's supporters and financial-based crowdfunding projects (Ordanini et al., 2011; Galak et al., 2011; Allison et al., 2015). Also, it is found that crowdfunding communities like Kickstarter ensure the significance of prosocial motivation (Kuppuswamy & Bayus, 2016). "Kickstarter Effect" means that "more than 90% of the projects that reached at least 30% of their goal eventually achieve their target goal" (Kuppuswamy & Bayus, 2016, p73), and it can be explained by impact theory. Setting targeted goals as well as amount of fundraising also put significant impact on the rate of success, and it results from impact theory, which can illustrate that the closer to target goal but not over, the higher possibilities of success a project owns. Whether the targeted goal is achieved or not, becoming a breakpoint and projects above \$ 5000 USD is eligible enough to influence success (Kuppuswamy & Bayus, 2016; Mollick, 2014).

It is found that the goal gradient effect (Kuppuswamy & Bayus, 2016), including motivation, target goal size, and early project support do remarkably dominate the process of fundraising. Goal gradient effect means that people tend to enhance their efforts when a goal is closer that's in proximity. Though the past studies regarding goal gradient effect focus on the motivation to achieve a goal with the increase of goal proximity. (Hull, 1932) Yet, past studies are restricted to smaller-scale laboratory experiments, Kuppuswamy and Bayus (2016) enhance the effects of goal proximity with larger-scale fields. Namely, once the targeted goal is attained, the follow-up funders and funding contributors will decrease sharply. This assumption is based on goal gradient effect in groups (Higgins & Brendl, 1995; Forster et al., 1998 ; Toure-Tillery & Fishbach, 2011), and it is believed that contributions in the later-stage are much more influential than those in the earlier-stage. In contrast, when the funding goals are closer achieved, additional backers are more willing to support.

Though the target goal of amount has gone up and was actively proposed by the US Congress, Mollick (2014) pioneered to explore motivated origins of successful crowdfunding. It is obvious that different projects with different levels of fundraising amounts do impact on outcomes. The projects above \$ 5000 USD (Mollick, 2014) are picked, and the ways of delivering the projects, including the quick-updated video, Kickstarter-featured projects and more profile pages' links on social networking do have a positive effect on the success of fundraising, while the spelling error doesn't. Moreover, geography does influence investments, yet crowdfunding mitigates geographic constraints. Mollick's

research (2014) tested the theory of Florida (2002, 2004, 2012), higher creative population of an area is related to higher successful rates for funders.

Several studies focus on exploring the incentives of capital seekers and capital providers. Crowdfunding is a way to secure funding and to address the funding gap in the early stage of the organizational life cycle (Moritz, & Block, 2016), which is the main reason for capital seekers to participate in crowdfunding. Gerber, Hui, & Kuo (2012) conducted a qualitative study to investigate the motivations of project creators and funders. Instead of financing, the study found that forming social networks, replicating success, and validating ideas and products are the reasons why the creators participate in crowdfunding as well. Some studies even suggest that crowdfunding can increase product consumption and the accessibility to customers, press, employees, and outside funders (Burtch, et al., 2013; Mollick & Kuppuswamy, 2014).

As for the capital providers, they are motivated by the rewards, the identification with the products, and the social networks (Gerber, et al., 2012; Ordanini, et al., 2011). Some studies have investigated the determining factors of crowdfunding success. Mollick (2014) suggests that personal networks, underlying project quality, and geography are factors associated with funding success. Colombo, et al., (2015) further delve into the social network area and develop the concept of internal social capital. Cai, et al., (2021) even offer a comprehensive review of how internal and external social capital influence crowdfunding dynamics. Agrawal, et al., (2011) focus more specifically on investigating geography factors of crowdfunding success and indicate that geography proximity does influence crowdfunding success. Some studies explore which underlying project quality influences crowdfunding success. Ahlers, et al., (2015) examine the impact of venture quality (human capital, social capital, intellectual capital) and uncertainty on fundraising success. Bi, et al., (2017) further use online information of crowdfunding platforms as underlying project quality to investigate the factors of fundraising success. Thus, we hypothesize:

Hypothesis 1: There exists a positive relationship between introduction word count and fundraising amount through the crowdfunding platform.

Hypothesis 2a: There exists a positive relationship between image count and fundraising amount through the crowdfunding platform.

Hypothesis 2b: There exists a positive relationship between gif image count and fundraising amount through the crowdfunding platform.

Hypothesis 2c: There exists a positive relationship between video count and fundraising amount through the crowdfunding platform.

Hypothesis 3a: There exists a positive relationship between unboxing video count and fundraising amount through the crowdfunding platform.

Hypothesis 3a: There exists a positive relationship between update count and fundraising amount through the crowdfunding platform.

Hypothesis 3b: There exists a positive relationship between comments and fundraising amount through the crowdfunding platform.

Hypothesis 3c: There exists a positive relationship between FAQ count and fundraising amount through the crowdfunding platform.

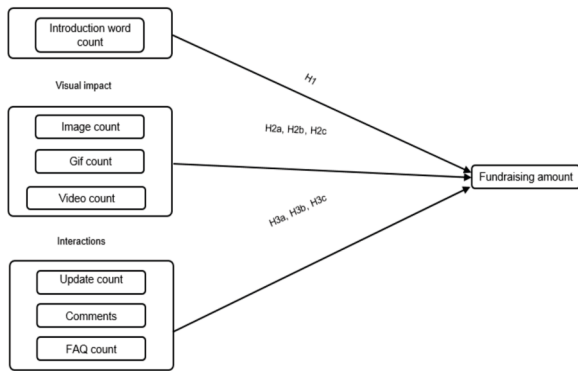


Figure 1 Conceptual framework of the relationship between signals and the fundraising amount

Figure 1 reveals the relationship between signals and the fundraising amount. We use fundraising amounts as the criteria to distinguish crowdfunding project's success. We denote each independent variables as follow:

Introduction word count is a word impact signal which influences capital providers' investment decisions and thereby influence the fundraising amount. Introduction word count is the number of words used to describe a crowdfunding project, including the subtitle and the description sections of the website page.

Image count, gif count, and video count are regarded as visual impact signals that increase the details, vividness, and persuasiveness of crowdfunding projects, thus; would probably enhance the fundraising amount. Video count is the amount of the videos inserted in a crowdfunding project except for the unboxing videos.

Update count, comments, and FAQ count, they are categorized as interaction signals since they represent the communications between capital seekers and capital providers which enhance the transparency of crowdfunding projects and further convince capital providers. In conclusion, we sort out four kinds of signals which are word impact, visual impact, recommendations, and interactions. Each of the signals has its related variables influencing fundraising amount. Update count is the amount of updating information from crowdfunding project initiators, which is displayed on the top of the main content of the crowdfunding project webpage. Comments is the number of comments from crowdfunding project backers, which is displayed on the top of the main content of the crowdfunding project webpage as well. FAQ count is the amount of the frequently asked questions inserted by the crowdfunding project initiators, which is displayed on the top of the main content of the crowdfunding project webpage as well.

3. Data and Methodology

In this section, we provide our samples and sample selection criteria. We collect data from publicly available information on crowdfunding platform Kickstarter which is one of the major crowdfunding platforms in the world. Kickstarter discloses project-related details: fundraising goals, project duration, and introduction and description of the projects. In addition to the project-related details, real-time performance is available as well, including the final fundraising amount, the ratio of fundraising amount over the goal, the number of funders, updates, comments, and FAQs.

We also use the Python programming language to extract all the project information related to our sample. We collected a total of 164 renewable energy related crowdfunding projects. The main themes are product design, gadgets, and hardware. Finally, we apply hierarchical multiple regression model to analyze the impact of the above-mentioned dependent

variables (introduction word count, video count, unboxing video count, unboxing video count from crowdfunding platforms, update count, comments, and FAQ count) on fundraising amount. The regression models are structured as follows:

Fundraising amount = 0 + 1 (Introduction word count) +	(1)
Fundraising amount = 0 + 1 (Introduction word count) + 2 (Image count) + 3 (Gif count) + 4 (Video count) +	(2)
Fundraising amount = 0 + 1 (Introduction word count) + 2 (Image count) + 3 (Gif count) + 4 (Video count) + 5 (video count) +	(3)
Fundraising amount = 0 + 1 (Introduction word count) + 2 (Image count) + 3 (Gif count) + 4 (Video count) + 5 (video count) + 7 (Update count) + 8 (Comments) + 9 (FAQ count) +	(4)

4. RESULTS AND ANALYSIS

The average fundraising amount is US\$ 31,570 and the highest fundraising amount is US\$511,207.57 based on Table 1. In addition, Table 1 also describes the status of Image count, Gif count, Video count, Update count, Comments, FAQ count and Introduction word count.

Table 1 Descriptive statistics of dependent and independent variables

Variable	N	Mean	SD	Min	Max
Fundraising amount	164	31,570.40	75,596.04	0	511,207.57
Image count	164	13.8	12.7	0	59
Gif count	164	1.17	2.8	0	21
Video count	164	1.92	1.93	0	14
Update count	1,289	7.6	10.3	0	49
Comments	1,289	70.53	216.45	0	2,057
FAQ count	1,289	2.95	5.11	0	28
Introduction word count	1,289	5,144.14	4,229.18	0	23,930

The results of the correlation table indicate that there are significant positive correlations between independent and dependent variables. The fundraising amount and image count (15.5%) , gif count (17.2%), video count (8.1%), update count (57.2%), comments (75.2%),FAQ count (33.3%), and introduction word count (11.7%) are positively correlated.

Table 2 Correlations of variables

Variable	1	2	3	4	5	6	7	8
1.Fundraising amount	1							
2. Image count	0.155*	1						
3. Gif count	0.172*	0.417**	1					
4. Video count	0.081	0.346**	0.157*	1				
5. Update count	0.572**	0.304**	0.163*	0.032	1			
6. Comments	0.752**	0.231**	0.227**	0.048	0.572**	1		
7. FAQ count	0.333**	0.348**	0.211**	0.025	0.34**	0.31**	1	
8.Introduction word count	0.117	0.554**	0.139*	0.27* *	0.305**	0.081	0.233**	1

** . Correlation is significant at the 0.01 level (2-tailed).

We also apply hierarchical regression analysis to further determine which factors influences the fundraising amount and the results is revealed in Table 3. We can observe that in model 1 the beta coefficient of introduction word count is positive and significant level is 0.117(p<0.05). In model 2, the variables include Image count, gif count, and video count. The

results show that the addition of these variables improves explanatory power of the model ($\Delta R^2 = 0.017$) and the beta coefficient is 0.060 ($p < 0.05$), 0.057 ($p < 0.05$) · 0.137 ($p < 0.05$), and 0.024 ($p < 0.05$). We then add update count, comments, and FAQ count in model 3 which further strengthen the explanatory power to $\Delta R^2 = 0.595$ with the beta coefficient of 0.032 ($p < 0.05$), 0.0140 ($p < 0.05$), 0.170 ($p < 0.05$), 0.079 ($p < 0.05$), 0.207 ($p < 0.05$), 0.622 ($p < 0.05$), 0.105 ($p < 0.05$) for each of the variable.

Table 3 Hierarchical multiple regression analysis (all samples, all categories).

Hierarchical variable	Variable	Model 1	Model 2	Model 3
Word impact	Introduction word count	0.117	0.060	0.032
Visual impact	Image count		0.057	-0.140
	Gif count		0.137	0.170
	Video count		0.024	0.079
Interactions	Update count			0.207
	Comments			0.622
	FAQ count			0.105
Model summary	F	2.236	1.712	35.241
	R ²	0.014	0.041	0.613
	ΔR^2	0.008	0.017	0.595

The overall results demonstrate that interaction category such as update, comments, and FAQ exhibit strong impact on fundraising results. It might be logical to infer that interaction is a strong signal during crowd funder's evaluation process. On the other hand, Crowd funders react moderately to visual impact such as Gif and video. Finally, word impact is a relative weak signal in crowd funder's decision-making process.

5. CONCLUSION

There is a visible investment gap in renewable energy. Many countries have set out to resolve this gap through various investment sources. Crowdfunding platforms such as Kickstarter allows the average potential investors to interact with the solution providers. However, the average crowd funders do not have sufficient time to conduct a thorough due diligence on the investment. At the results, there exist a significant information asymmetry problem in the crowdfunding platform. Investors can only rely on online signals to aid their decision-making. We set out to examine the impact of online information on renewable energy crowd funder's investment decision. We find that interaction correlates with fundraising success. Furthermore, word impact is a relatively weak signal in crowd funder's investment decision. Zheng et al., (2014) suggest that information signals have positive effect on crowd funder's investment decision. Our results have further stressed the importance of interaction on renewable energy related projects. Renewable energy related projects should be prepared to answer questions from their potential supporters. It might not be enough for renewable energy projects to rely solely on descriptive content to gain financial support. Our findings also indicate the possibility of using more interactive tool to mitigate crowd funder's information asymmetry concerns. Having an attractive descriptive content is crucial to gain supporter's attention but interaction provides further supporter acquisition potential. Results of this research offer project creators a guideline when designing their crowdfunding fundraising activities.

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